

CLAIMS

We claim:

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1. A method for determining positional relationships among objects represented in a
database, the method comprising:
defining a plurality of tiles;
determining a distribution of objects with respect to the tiles;
comparing the distribution of objects with respect to the tiles to identify objects fulfilling
a primary filter condition comprising an interaction of the objects with respect to the tiles;
identifying objects that fulfill a secondary filter condition, comprising an interaction of
the geometries of the objects, by analyzing the distribution of objects that fulfill the primary filter
condition with respect to the tiles; and
identifying objects that fulfill the secondary filter condition by comparing geometries of
objects that fulfill the primary filter condition that the analysis does not identify as fulfilling the
secondary filter condition.

2. The method according to claim 2, wherein determining a distribution of objects with
respect to the tiles comprises identifying interior tiles that intersect an object while all of a
boundary of the object lies outside the interior tiles and boundary tiles that intersect a boundary
of the object.

1 3. The method according to claim 3, wherein determining whether the primary filter
2 condition is fulfilled comprises comparing the boundary tiles and interior tiles of each object.

1 4. The method according to claim 2, wherein the primary filter condition includes at least
2 one member selected from the group comprising:

3 a first object in a second object, a second object contained by a first object,
4 a first object in a second object where a boundary of the first object intersects a boundary
5 of the second object,

6 a first object covering a second object where a boundary of the first object intersects a
7 boundary of the second object,

8 a first object outside a second object where a boundary of the first object intersects a
9 boundary of the second object,

10 a first object does not cover a second object where a boundary of the first object
intersects a boundary of the second object,

11 a first object overlaps a second object but the boundaries of the first object and the second
13 object do not touch,

14 a first object overlaps a second object and the boundaries of the first object and the
15 second object touch,

16 a first object is equivalent to a second object, and

17 a first object is disjoint from a second object.

1 5. The method according to claim 4, wherein determining whether the primary filter

2 condition is fulfilled comprises comparing the boundary tiles and interior tiles of each object.

1 6. The method according to claim 4, wherein the secondary filter is applied only to
2 objects fulfilling the primary filter and a subset of the group of primary filter conditions.

1 7. The method according to claim 1, wherein the tiles all have at least one of the same
2 size and the same shape.

8. The method according to claim 7, wherein the tiles are rectangular.

9. The method according to claim 1, wherein the tiles have different sizes.

1 10. The method according to claim 1, wherein the database comprises geometries of the
2 objects on a surface or in a three-dimensional space.

1 11. The method according to claim 10, wherein the database stores the exact geometries
2 and approximations of the geometries.

1 12. The method according to claim 1, wherein geometries comprise polygons and the
2 method determines positional relationships among polygons.

1 13. The method according to claim 11, wherein the geometries comprise linestrings and
2 polygons and the method determines positional relationships among the polygons.

1 14. The method according to claim 13, wherein the linestrings represent streets and the
2 polygons represent a geographic region, and the method determines streets that at least partially
3 fall within the geographic region.

1 15. The method according to claim 14, wherein the geographic region includes a member
2 selected from the group comprising counties, cities, and zip code regions.

1 16. The method according to claim 1, wherein the geometries are mathematically
2 compared.

1 17. The method according to claim 1, wherein the data is organized with a linear
2 quadtree index.

1 18. The method according to claim 1, wherein the secondary filter is applied only to a
2 subset of objects fulfilling the primary filter condition.

1 19. The method according to claim 1, further comprising:

2 assigning each tile a tile code and an associated geometry as the tiles are defined.

1 20. A computer program product for performing a process for determining positional
2 relationships among objects represented in a database in a computer system, comprising:
3 a computer readable medium; and
4 computer program instructions, recorded on the computer readable medium, executable
5 by a processor, for performing the steps of:
6 defining a plurality of tiles;
7 determining a distribution of objects with respect to the tiles;
8 comparing the distribution of objects with respect to the tiles to identify objects fulfilling
9 a primary filter condition comprising an interaction of the objects with respect to the tiles;
10 identifying objects that fulfill a secondary filter condition, comprising an interaction of
11 the geometries of the objects, by analyzing the distribution of objects that fulfill the primary filter
12 condition with respect to the tiles; and
13 identifying objects that fulfill the secondary filter condition by comparing geometries of
14 objects that fulfill the primary filter condition that the analysis does not identify as fulfilling the
15 secondary filter condition.

1 21. A system for performing a process method for determining positional relationships
2 among objects represented in a database, comprising:
3 a processor operable to execute computer program instructions; and
4 a memory operable to store computer program instructions executable by the processor,
5 for performing the steps of:

6 defining a plurality of tiles;
7 determining a distribution of objects with respect to the tiles;
8 comparing the distribution of objects with respect to the tiles to identify objects fulfilling
9 a primary filter condition comprising an interaction of the objects with respect to the tiles;
10 identifying objects that fulfill a secondary filter condition, comprising an interaction of
11 the geometries of the objects, by analyzing the distribution of objects that fulfill the primary filter
12 condition with respect to the tiles; and
13 identifying objects that fulfill the secondary filter condition by comparing geometries of
14 objects that fulfill the primary filter condition that the analysis does not identify as fulfilling the
15 secondary filter condition.

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